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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/886,984	06/25/2001	Ji-Suk Hong	P 276570 P00HA103/US	7045

909 7590 11/26/2002

PILLSBURY WINTHROP, LLP
P.O. BOX 10500
MCLEAN, VA 22102

EXAMINER
SAGAR, KRIPA

ART UNIT	PAPER NUMBER
1756	4

DATE MAILED: 11/26/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

AS-4

Office Action Summary	Application No.	Applicant(s)	
	09/886,984	HONG ET AL.	
	Examiner	Art Unit	
	Kripa Sagar	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *6./25/01 and 9/18/01* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. 6120942 to Reinberg in view of US Pat.5482799 to Isao et al.

The invention is directed towards a method of making a multi-layered photomask with different transmittance in different regions of the mask.

Claims 1-4 define the basic structure of the mask while claims 5-12 and 13-18 recite the limitations on two embodiments of the fabrication of the mask.

Reinberg teaches a method of making a photomask with multiple absorption levels in different parts of the mask. The levels are generated by a stack of light blocking layers (12,14,16) laid on a substrate as shown in Fig.1. The layers are interspersed with etch barriers 20 and 22. The etch barriers are comprised of transparent SiO2. The stack is patterned to remove different layers as shown in Figs.2. and 3. The transmittance in area A is less than that in B which in turn is less than that in area C (Fig.2). In Fig.3 area D would have the highest transmittance. The light

absorbing layer could be Cr (4;26-35). The transmittance of each layer can be controlled by the thickness of the layer and composition (deposition conditions. 5;60-65). The transmittance of a given stack can be calculated from well known optical formulae (6;8-20). Reinberg teaches that each layer reduces the intensity by a factor (I/I_0) corresponding to its transmittance T_i. Thus the transmittance of a beam passing through layers with transmittance of T1,T2 and T3 would be easily calculated as T1* T2*T3. Reinberg teaches that by varying the number of layers and the transmittance of each layer the transmittance can be controlled to any desired value and could be made opaque ($I/I_0 < 0.4\%$). Thus Reinberg teaches most of the elements of claims 1-3,5-7,9-14,16-18.

Reinberg teaches that the incorporation of a phase shift layer is known in prior art; an attenuation phase shift mask (Att.PSM) can be fabricated with two levels of light transmission in a single mask (1;45-56). By themselves phase shifters do not offer significant control on the transmittance of a mask. Reinberg does not specifically teach their incorporation in a multilevel stack. It does not teach the use of an oxide for the phase shifting layer.

Isao teaches a multilayered halftone mask with a Cr layer and a halftone layer comprising an oxide (Fig.15,16). The transmitted intensities passing through the phase shifting layers would be shifted by 180 deg. as claimed in claims 11,12 . Thus Isao teaches the elements of claims 1,4,5,8,11-13,15.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include a phase shift layer as taught by Isao in Reinberg's multi-

level mask because Isao teaches that in these structures defect detection in the mask is facilitated by the inclusion of the phase shift layer in an attenuating layer (4;45-58).

3. Claims 1-18 are further rejected under 35 U.S.C. 103(a) as being unpatentable over Reinberg in view of US Pat. 5906910 to Nguyen et al.

The teachings of Reinberg have been discussed above. It does not specifically teach including a phase shift layer in the multi-level stack. It does not teach the phase shifting of the transmitted intensities.

Nguyen teaches a multilevel mask with varying transmission through the different levels (Fig.13). In one embodiment, the layers include a halftone phase shifter (Fig.18). The phase shifter is an oxide (7;63-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a phase shifting layer as taught by Nguyen in a multilevel mask formed by Reinberg's method because Nguyen teaches that the combined attenuation characteristics and phase shifting characteristics of the mask increase the contrast and reduces errors caused by diffraction (4;36-41).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 703-605-4427. The examiner can normally be reached on 8:00AM--5:00PM (M-F).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 703-308-2464. The fax phone numbers for

the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

MH/ks
November 15, 2002